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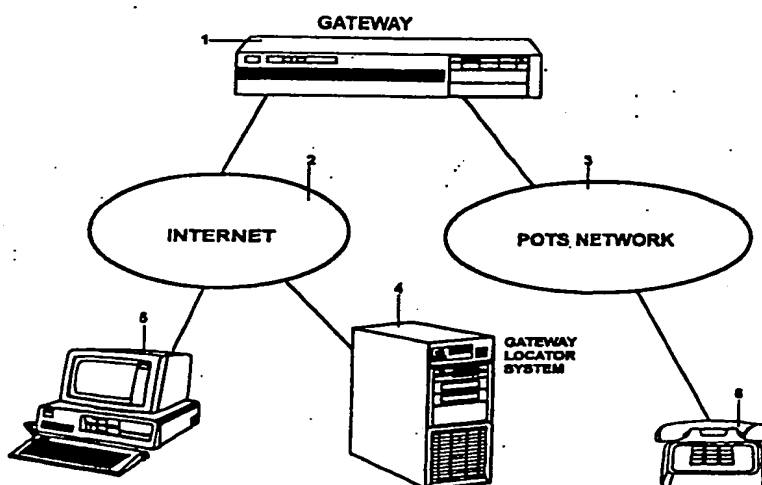
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(57) Abstract

The invention provides an Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission medium for said services, and in which said telecommunication system includes at least one telephone network; a gateway system, including a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between Internet users and users of said at least one telephone network, and between said telephone network users; and a gateway locator system connected to the Internet and adapted to locating that one of said set of gateways which is best suited for a particular telephone call. The gateway system is adapted to support a number of connectivity arrangements for said telephone networks and said Internet users, for example, telephone call connections over the Internet between a user of a computer connected to the Internet and a user of said at least one telephone network and vice versa, and/or telephone call connections over the Internet between Internet computer users and between users of said telephone networks.

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INTERNET TELEPHONY

The invention relates to an Internet telecommunication system, a gateway system for said telecommunication system, and a method for processing telephone calls over the Internet.

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It is known to provide telephony, or telephony-like, services between computers attached to the Internet. In fact, such services are already widely used on the Internet. However, viable solutions for interworking between telephones which are connected to the telephone (POTS) network, and computers which are attached to the Internet, are not readily available. A gateway system that bridges the POTS network and the Internet must perform a number of functions, namely, bridging, routing address/number conversion, charging and call monitoring.

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A gateway system must bridge the synchronous POTS network with the asynchronous Packet Network (Internet). Since most Voice-over-Network (VON) implementations apply some kind of voice compression scheme which differs from the PCM (Pulse Code Modulation)/ADPCM (Adaptive Differential PCM) schemes used in POTS networks, it will be necessary for the gateway system to provide a coding/decoding function.

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As for routing address/number conversion, a POTS telephone user must be able to address, i.e. dial, an Internet computer either by using some special dialling system for IP (Internet Protocol)-addresses, for example, Ex 131#115#49#175, or by aliasing the Internet computers in the POTS numbering plan and having the gateway translate into IP-numbers using pre-configured tables. The Internet computer user must be able to dial international telephone numbers and the system should be adapted to select the gateway that will minimise the POTS network distance used. At least, a gateway located in the

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country indicated by the country code in the dialled number should be selected. The process should be automatic and the user should not be required to manually select a suitable gateway from the potentially large set of such gateways.

5 Also, the gateway system must provide for the charging the users of the gateway service. For POTS initiated calls, a system using primary rate (071-) numbers can be used. For Internet initiated calls, other methods must be applied since the Internet does not provide a native charging mechanism like the Toll Ticketing applied in the POTS network.

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The gateway system must also be able to monitor call progress and clear broken connections. The gateway must, therefore, perform both application level as well as Transport and Network level functions.

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Furthermore, a pair of gateway systems should be able to establish telephony connections, i.e. POTS telephone to POTS telephone over the Internet.

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According to a first aspect of the present invention, there is provided, an Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission for said services, characterised in that said telecommunication system includes a gateway system adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:

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- Internet users and users of said at least one telephone network; and
- said telephone network users.

According to a second aspect of the present invention, there is provided, an Internet telecommunication system in which telephony and related services

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are provided using the Internet as a transmission medium for said services, characterised in that said telecommunication system includes:

- at least one telephone network;
- a gateway system, including a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:
 - Internet users and users of said at least one telephone network; and
 - said telephone network users; and
- a gateway locator system connected to the Internet and adapted to locating that one of said set of gateways which is best suited for a particular telephone call.

According to a third aspect of the present invention, there is provided, a gateway system for an Internet telecommunication system, characterised in that said gateway system is adapted to connect a telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:

- Internet users and users of said at least one telephone network; and
- said telephone network users.

The gateway system preferably includes a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet, and a gateway locator system for locating that one of the set of gateways which is best suited for a particular telephone call. The telephone networks may be POTS networks.

In a preferred arrangement, the gateway includes a WWW server; a VON package; a charging system; proxy processing means; a TCP/IP interface; an IVR system; a POTS interface; and call control and monitoring means for

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controlling and monitoring said proxy process, VON package, and charging system, in that said WWW server is connected to said VON package, said charging system, said proxy process means, and said TCP/IP interface, and in that said IVR system is connected to said charging system and said POTS interface. The gateway preferably has a hardware platform in the form of a high-performance personal computer which includes a TCP/IP interface and an IVR system.

The gateway locator system may include a WWW server and a DNS system and is preferably adapted to support a number of connectivity arrangements for said telephone networks and said Internet computers. For example, telephone call connections, over the Internet, between an Internet computer and a user of said telephone networks and vice versa, and/or telephone call connections, over the Internet, between Internet computers and between users of said telephone networks.

According to a fourth aspect of the present invention, there is provided, in an Internet telecommunication system as outlined in preceding paragraphs, a method for processing telephone calls over the Internet, characterised by the steps of a gateway location phase, a call connection phase, a call connected phase and call disconnect phase.

When the calling party is a user of an Internet computer and the called party is a user of a telephone network, the gate location phase of the method of the present invention includes the steps of the computer user (a) dialling the number, including the country code, of the called party, (b) using a web-browser of the computer user, in an HTML FORM provided by a WWW server at said gateway locator system, (c) choosing, or pre-configuring, a required VON package and Payment System for the call, and (d) on actuation of a 'Submit' button, the web-browser validating the dialled number and, if syntactically

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correct, submitting the information to the WWW server at said gateway locator system; the WWW server consulting a Naming System that finds the most suitable gateway for the telephone call, the WWW server generating new web-pages including a clickable gateway button with associated URL, corresponding to a first preference gateway, second preference gateway etc., each URL having associated therewith either the number dialled by the computer user, or a new number in those cases where a redirect was encountered in the search phase; the computer user then clicks a gateway button and is connected to a web-server at the gateway; and the dialled, or new, number, is transferred to the gateway, together with the VON and billing information, the IP address of the calling computer being automatically transferred to the gateway by means of HTTP. The validation of the dialled number may be effected using a Java-script associated with the HTML FORM and the method of the present invention may use the same HTML syntax, as for Internet search-engines.

The call connection phase for the computer-telephone network connectivity arrangement, referred to above, includes the steps of said gateway web-server transferring a web-page with an 'Accept' and an 'Abort' button to the calling computer; the gateway establishing a connection to the calling computer using said VON package; the computer user accepting the incoming call, if not automatically accepted; an IVR system of the gateway issuing a voice message signal to inform the computer user concerning the charges which apply to the dialled telephone number; and the Payment System which has been chosen, and to instructing the computer user to push the 'Accept' button; the computer user pushing the 'Accept' button and thereby causing a Call Progress Web-page to appear, said web-page containing a Java-script that periodically requests reload of this web-page from the server; the gateway web-server then attempts to establish a call connection to the dialled telephone number, said VON package enabling the computer user to listen to the progress of the call; when a call connection is established, the called party answers the call; and issuing

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an initial payment request to the computer user, if Ecash is used as the payment method, or initiating a charging record for the call. In a preferred method, the Call Progress Web-page contains information about the status of the call and, if Ecash is used, shows, in a 'time left' field, how many seconds are left for use by the calling party before a new deposit is necessary.

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During the call connected phase of the computer-telephone network connectivity arrangement, referred to above, the method of the present invention includes the steps of the Call Progress Web-page informing the computer user of the current status of the call and, if Ecash is used, providing the computer user with a 'New Deposit' button for actuation by the computer user when a new Ecash deposit is required. Actuation of the 'New Deposit' button causes a CGI-script to be started at the gateway web-server which issues an Ecash payment request to the computer user and, on receipt of an Ecash deposit, the gateway web-server increase the 'time left' field on the Call Progress Web-page.

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The call disconnection phase of the computer-telephone network connectivity arrangement, referred to above, includes the steps of, in the event that either party disconnects the call, the gateway web-server modifies the Call Progress Web-page to inform the computer user that the call has been terminated, and the reason for termination; the computer user is given the option, through use of clickable buttons, to either reconnect, or 'quit', the call; and, in the event that the computer user clicks the 'quit' button, the computer is connected to the gateway locator system and, if a charging record is open, it is now closed.

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When the calling and called parties are each a user of an Internet computer, the method of the present invention for processing telephone calls between said Internet computer users is effected in a manner as outlined in preceding paragraphs for the computer-telephone network connectivity

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arrangement except that, during the gateway location phase, an IP number, or domain address, is entered by the calling party, rather than a telephone number.

When the calling party is a user of a telephone network and the called party is a user of an Internet computer, the gate location phase of the present invention includes the step of the telephone network user dialling the number to the user's service provider and being routed to a gateway best suited for the call. The routing of the call to a gateway may be effected using automatic call distribution techniques to obtain load balance between gateways.

The call connection phase for the telephone network-computer connectivity arrangement, referred to above, includes the steps of the telephone network user (a) receiving a voice message signal (prompt) requesting the selection of a connection to either another telephone, or an Internet computer; and (b) selecting the Internet computer using touch-tone dialling; requesting the telephone network user to enter an IP-number, said entry being read back to the user by the gateway for verification by the user; a web-server of the gateway consulting a DNS to verify the address of the called Internet computer; the gateway, on verification of the address, establishing a connection to the called Internet computer using an appropriate VON package, the calling party being informed of the status of the call by call progress audio signals; and the called party answers the call, on establishment of the connection. Access may be obtained either through a freephone-number, in which case the calling party is requested to provide a PIN-code, or 'primary rate', in which case additional charging is not required. The gateway web-server may verify the VON package capability of the calling Internet computer.

During the call disconnection phase of the telephone network-computer connectivity arrangement, referred to above, either party can disconnect the call. In the event that the called party disconnects (hangs up), the telephone network

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user has the option to either initiate another call, or hang up.

When the calling and called parties are each a user of a telephone network, the call process method of the present invention involves the use of two gateways, one of which ('Ingress' gateway) is used to initiate a point of entry for a telephone network user to the Internet, and the other one of which ('Egress' gateway) is the gateway where the call exits the Internet and enters the telephone network to access the called number. With this connectivity arrangement, the gateway location phase for the 'Ingress' gateway includes the steps of the telephone network user (a) dialling the number to the user's service provider and being routed to a gateway best suited for the call, (b) receiving a voice message signal (prompt) requesting selection of a connection to a telephone network, or an Internet computer, and (c) selecting an Internet computer using touch-tone dialling; the telephone user is then requested to enter the telephone number of the called party, the input being read back to the telephone user by the gateway for verification by the telephone user; and, on verification of the called party number, the gateway initiates a proxy process for the called party involving contacting said gateway location system for location of an 'Egress' gateway for the call. The remaining interactions in the gateway location phase for the 'Egress' gateway are effected in a manner as outlined in preceding paragraphs for the computer-telephone network connectivity arrangement. The routing of the call to a gateway may be effected using automatic call distribution techniques to obtain load balance between gateways. The access may be obtained either through a freephone-number, in which case the calling party is requested to provide a PIN-code, or 'primary rate', in which case additional charging is not required.

The call connection phase for the telephone network-telephone network connectivity arrangement, referred to above, are effected in a manner as outlined in preceding paragraphs for the corresponding phase of the computer-

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telephone network connectivity arrangement. During the call disconnection phase, either party can effect disconnection. In the event that disconnection is effected by the called party (hangs up), the calling party has the option to initiate another call, or hang up.

5 The foregoing and other features according to the present invention will be better understood from the following description with reference to the accompanying drawings, in which:

10 Figure 1 diagrammatically illustrates an Internet communication system according to the present invention;

 Figure 2 illustrates a simplified 'time diagram' which summarises the interactions of the various phases of a call process using the Internet communication system of the present invention;

15 Figure 3 diagrammatically illustrates, in the form of a block diagram, an architecture for the Gateway 1 shown in Figure 1 of the accompanying drawings; and

20 Figure 4 sets out, in a table, the connectivity scenarios for the Internet communication system of the present invention.

25 In accordance with the present invention, means are provided to enable a service provider to operate a set of gateways as a coherent system. It will be seen from subsequent description that a gateway locator provides a starting point for interaction with Internet computer users and a uniform interface to the set of gateways. The underlying assumptions of the present invention are that the Internet will provide a more cost-effective long-distance transport of voice traffic and that the gateway selected for a call towards a POTS telephone should

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be as close as possible to that particular POTS access.

An Internet communication system, according to the present invention, is diagrammatically illustrated in Figure 1 of the accompanying drawings and is adapted to support the connectivity scenarios set out in the table shown in Figure 4 of the accompanying drawings. The communication system includes, at least, a Gateway 1 connected to the Internet 2 and to a POTS Network 3, a Gateway Locator System 4 connected to the Internet 2, a computer 5 connected to the Internet 2 and a telephone 6 connected to the POTS Network 3.

The Gateway 1 of Figure 1 consists of a set of communication sub-systems which are diagrammatically illustrated, in the form of a block diagram, in Figure 3 of the accompanying drawings.

As illustrated in Figure 3, the Gateway 1 architecture includes a Call Control and Monitoring Sub-system 7 for controlling and monitoring operation of sub-systems 8, 9, 10 and 11, respectively for a Proxy Process, to be subsequently outlined, a VON-package, a Charging System and a POTS Interface. A WWW-server 12 is connected to Sub-systems 8, 9 and 10, and to a Transmission Control Protocol (TCP)/IP Interface 13. An Interactive Voice Responsive (IVR) Sub-system 14 is connected to the Sub-systems 9, 10 and 11.

The hardware platform for the Gateway 1 is a high-performance personal computer (PC), for example, a PC with a Pentium processor and equipped with a TCP/IP Interface card and an IVR board with POTS interface.

The Gateway Locator System 4 of Figure 1 consists of a WWW-server and a DNS (Domain Name System) sub-system.

In operation, the Gateway 1 is primarily targeted at scenarios 1 and 2 of

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Figure 4. In the case of scenario 4 of Figure 4, the Internet 2 is really acting as a transport network for POTS. In the case of scenario 3 of Figure 4, the present invention gives very little added value, compared to existing solutions for a voice-over the Internet service, but it is included in order to facilitate heterogeneous teleconferencing with both POTS telephones and computers.

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The Gateway Locator System 4 provides a comprehensive interface to a particular service providers gateway system. The Internet user interacts with the Gateway Locator System 4 to find the most appropriate gateway to use for a particular call. Likewise, for calls from POTS to POTS over the Internet 2, the ingress (entry) gateway uses the Gateway Locator System 4 to find the most appropriate egress (exit) gateway.

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The dialogue with the Gateway Locator System 4, as well as the control dialogue between an Internet computer 5 and the Gateway 1 is performed by means of the World Wide Web (WWW).

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The call process for the Internet telecommunication system of the present invention can be divided into number of phases, namely, a gateway location phase, a call connect phase, a call connected phase and a call disconnect phase. The first phase may be shortcut if the user already knows an appropriate gateway.

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The required interactions for each of these phases will be subsequently outlined for the four interconnection scenarios referred to above and set out in the table shown in Figure 4 of the accompanying drawings.

25

In the case of the first scenario, i.e. scenario 1 of Figure 4 where a call is initiated by a computer user and the called party (responder) is a POTS telephone subscriber, the call process is as follows:

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A. Gateway location phase

1. A user of the computer 5 uses his/her web-browser to enter (dial) the number, including the country code, of the POTS telephone 6 in an HTML (Hypertext Markup Language) form, provided by the WWW-server at the Gateway Locator System 4. The computer user also has to choose, or pre-configure, the required VON-package and Payment System for the call.

2. The computer user then pushes a 'Submit' button and the web-browser validates the dialled number using a Java-script associated with the HTML FORM and, if syntactically correct, submits the information to the WWW-server (locator). Java-script is scripting language for the WWW and is used, in the present invention, to validate user input in WWW-forms.

3. The WWW-server consults a Naming System that finds the most suitable gateways for this particular call.

4. The WWW-server generates new web-pages consisting of a clickable gateway button, with associated URL (Universal Resource Locator), corresponding to the first preference gateway, second preference gateway etc.. Associated with each Universal Source Locator (URL) is either the number dialled by the computer user, or a new number in those cases where a redirect was encountered in the search phase. The same HTML syntax, as for search-engines, is used, i.e. ` best-gw `. The text following the "?" is interpreted, not as search strings, but as the dialled number, VON-package to be used, and Billing Method to be used, respectively.

5. The computer user then clicks the gateway button and is connected to the web-server at the Gateway 1 and the number, VON and billing information is

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transferred to the Gateway 1. The Internet Protocol (IP) address of the calling computer 5 is automatically transferred by means of HTTP (Hypertext Transfer Protocol).

B. Connection phase

6. The web-server of the Gateway 1 transfers a web-page with an 'Accept' and an 'Abort' button to the Internet computer 5.

7. The Gateway 1 establishes a connection to the calling computer 5 using the identified VON-package.

8. The computer user accepts the incoming call (if not automatic accept).

9. An Interactive Voice Response (IVR) system of the Gateway 1 issues a voice message signal to inform the computer user concerning:

- the charges which apply to the telephone number he/she has dialled; and
- the Payment System which has been chosen;

and to instructs him/her to push the 'Accept' button.

10. The computer user pushes the 'Accept' button, (or the 'Abort' button in which case the Gateway 1 is disconnected from the server). A Call Progress Web-page then appears. The Call Progress Web-page contains a Java-script that periodically requests reload of this page from the server (using a loop with the 'History.go(0)' statement). The Call Progress Web-page contains information about Call Status (Connected/Disconnected/Connecting) and the accumulated cost for the call. If electronic cash (Ecash) is used, the page

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shows, in a 'time left' field, how many seconds are left for use by the caller before a new deposit is necessary.

11. The web-server of the Gateway 1 attempts to establish a call connection to the POTS telephone number which has been dialled by the computer user. The computer user can listen to the call progress through his/her VON-package. If Ecash is used as the payment method, an initial payment request is issued to the computer user.

12. When a call connection is established, the POTS telephone subscriber answers the call. If Ecash is used as the payment method, an initial payment request is issued to the computer user, otherwise a charging record is initiated.

C. Call connected phase

During the call connected phase, the Call Progress Web-page informs the computer user of the current status of the call. If Ecash is used, the Call Progress Web-page will provide the user with a 'New Deposit' button. When the computer user pushes this button, a CGI (Common Gateway Interface)-script is started at the web-server which will issue an Ecash payment request to the computer user. After receiving the deposit, the web-server will increase the 'time left' field on the Call Progress Web-page. The WWW-server at the Gateway 1 and Gateway Locator System 4 applies CGI to communicate with other programs.

D. Disconnect phase

13. If either party disconnects, the web-server of the Gateway 1 modifies the Call Progress Web-page to inform the computer user that the call has been terminated (and the reason for termination). The computer user is given the

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option, through the use of clickable buttons, to either reconnect, or 'quit', the call. If a charging record is open it is now closed.

14. The computer user clicks the 'quit' button and is connected to the Gateway Locator System 4.

5

The 'time diagram' illustrated in Figure 2 of the accompanying drawings is a simplified summary of the call process outlined above, i.e. some of the WWW interactions, referred to above, in the Gateway Location System 4 and connection phases have been omitted for the purposes of this summary.

10

In the case of the second scenario, i.e. scenario 2 of Figure 4 where a call is initiated by a POTS telephone 6 and the called party (responder) is a computer 5, the call process is as follows:

15

A. Gateway location phase.

1. A user of the POTS telephone 6 dials the number to his Service Provider and is connected to an available gateway. The Service Provider may use automatic Call Distribution Techniques to route the call to an appropriate gateway thus achieving load balance between gateways.

20

B. Connection phase

2. The POTS telephone user receives a voice message signal (prompt) requesting him/her to select a connection to another POTS-phone, or an Internet computer 5.

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3. The telephone user selects the Internet computer 5 using touch-tone dialling. If access is through a freephone-number, the telephone user is

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requested to provide a PIN-code. Access can also be obtained through 'primary rate' in which case additional charging is not needed.

4. The telephone user is asked to enter an IP-number in format 1111#2222#3333#4444#, or, alternatively, in domain name format aaaa#bbb#cc
5 using touch-tone coding of the alphabet, i.e. a single click of push button '1' for an 'a', a double click for a 'b' etc..

5. The input is read back to the telephone user by the Gateway 1 for verification by the telephone user.
10

6. The Web-server of the Gateway 1 consults a Domain Name Service (DNS) to verify the address of the called computer 5 and (possibly) the VON-package capability of the computer 5 - this process requires a DNS extension.

15 7. The Gateway 1, on verification of the address, establishes a connection to the computer 5, using the appropriate VON-package. The POTS telephone user can hear the call progress audio signals.

20 8. When the connection has been established, the computer user answers the call.

C. Call connected phase

Not applicable with this scenario.

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D. Disconnect phase

9. Either party disconnects. If the computer user disconnects (hangs up), the POTS telephone user has the option to initiate another call, or hang up.

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In the case of the third scenario, i.e. scenario 3 of Figure 4 where both the calling and called party is a computer user, the call process is identical to scenario 1 of Figure 4, i.e. computer 5 to POTS telephone 6, except that an IP-number, or domain address, rather than a telephone number is entered. As stated above, this scenario gives very little added value, compared to existing solutions for a two-party voice-over the Internet service, but may have relevance for multi-party teleconferencing with both POTS telephones and computers.

In the case of the fourth scenario, i.e. scenario 4 of Figure 4 where both the calling and called party is a POTS telephone user, the call process involves the use of two gateways, i.e. an 'Ingress' gateway for initiating the POTS telephone user's point of entry to the Internet 2 and an 'Egress' gateway via which the call will exit the Internet 2 and enter the POTS Network 3 to access the called number.

It will be seen from subsequent description that the process for selecting the 'Egress' gateway is identical to the gateway selection process of scenario 1 of Figure 4, i.e. computer 5 to POTS telephone 6. In fact, it will be seen that a 'proxy process' is initiated at the selected 'Ingress' gateway which involves contacting the Gateway Locator System 4 to find the 'Egress' gateway etc. in accordance with scenario 1. In practice, it will appear to the 'Egress' gateway that a computer user is trying to make the call, but it is, in fact, the 'proxy process'.

A. Gateway location phase

1. The user of a POTS telephone dials the required number to his Service Provider and is connected to an available gateway. The Service Provider may use automatic Call Distribution Techniques to route the call to an appropriate gateway thus achieving load balance between gateways.

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2. The user receives a voice message signal (prompt) requesting him/her to select a connection to a POTS-phone, or an Internet computer 5.

3. The POTS telephone user selects the Internet computer 5 using touch-tone dialling. If access is through a freephone-number, the telephone user is requested to provide a PIN-code. Access can also be obtained through 'primary rate' in which case additional charging is not needed.

4. The telephone user is requested to enter the telephone number of the destination, or called, telephone user.

5. The input is read back to the telephone user by the gateway for verification by the telephone user.

6. On verification of the called party number, the gateway starts the proxy process for this POTS telephone user.

7. The Gateway Location System 4 is then contacted, as part of the proxy process, and the remaining interactions in the 'Gateway location' phase are identical to those of the gateway location phase of scenario 1 of Figure 4.

B. Connection phase

The interactions in the connection phase are identical to those of the corresponding phase of scenario 1 of Figure 4.

C. Call connected phase

The interactions in the call connected phase are identical to those of the

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corresponding phase of scenario 1 of Figure 4.

D. Disconnect phase

8. Either party disconnects. If the called party disconnects (hangs up), the calling party, i.e. the POTS telephone user, has the option to initiate another call, or hang up.

The present invention is based on the integration of a set of different sub-system technologies in a single comprehensive telecommunications system. The individual sub-system technologies are briefly outlined in the following paragraphs.

A Voice over Network, or 'VON', is a set of emerging technologies for carrying voice traffic over packet networks. A VON-package known as 'IPHONE', from Vocaltec, is the widely used package, although other commercial, as well as public domain packages, are also readily available. All that is needed to use a VON-package is, typically, a 486 computer with 'Windows' software, a soundcard and a modem for connection to the Internet and having a reasonable operating speed, i.e. a minimum of 14.4 kbits/s.

Interactive Voice Response (IVR) systems are used to build information retrieval systems for POTS-telephone users using touch-tone dialling. A common application for these systems is known as 'Fax-Back'. An IVR system, typically, includes a powerful personal computer (PC) equipped with a soundcard and a special purpose board for handling the PC user's interaction with a communication system through voice-prompting and DTMF (Dual Tone Multi Frequency)-signalling. Typically, the special purpose board is adapted to process user dialling information and to transfer this information to a central logic system through a higher-level application interface. Advanced IVR special

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purpose boards interface directly to digital lines and provide functions for μ A-law Pulse Code Modulation (PCM), as well as Adaptive Differential PCM (ADPCM) and GSM (Global System for Mobile Communication) voice coding/decoding using Digital Signal Processor (DSP) technology.

5 Electronic cash, or Ecash, is designed for secure payments from any personal computer to any other workstation, over email, or the Internet. Ecash has the privacy of paper cash, while achieving the high security required for electronic network environments exclusively through innovations in public key cryptography. With Ecash client software, a customer can withdraw Ecash, i.e.
10 a form of digital money, from a bank and store it on his/her local personal computer. The personal computer user can then spend the digital money at any shop, or for any required service, which accepts payment by Ecash, without first opening an account with the shop/service provider concerned, or having to transmit credit card numbers. Because the received Ecash is for the full
15 monetary value of the transaction, shops/service providers can instantly provide the requested goods, or services. Person-to-person payments can also be made with Ecash. Ecash can be used with the World Wide Web (WWW) to construct 'Cybershops'. Ecash server software can interact with a web-server through CGI-scripts in such a way that a 'Payment' request is issued to the client
20 whenever the client clicks a particular "link" on the web-page. The design is really aimed at 'Cybershops' which are selling information in the form of files but through intelligent engineering it can be used for a payphone type application as well. This is achieved through the Call Progress Web-page, as described above for scenario 1 of Figure 4 of the accompanying drawings.

25 A Domain Name System (DNS) provides a name service (primarily name-to-address) translation for the Internet.

As previously stated, Java-script is scripting language for the World Wide

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Web (WWW). In the Internet communication system of the present invention, Java-script is used to validate user input in WWW-forms. The WWW-server at the Gateway 1 and Gateway Locator System 4 applies CGI (Common Gateway Interface) to communicate with other programs.

5 The main advantages of the Internet communication system of the present invention are that:

- 10 - the system does not demand any extra functionality in the use of an Internet computer;
- the routing function, i.e. choice of gateway, is effected automatically;
- the interface between two systems is totally integrated with the World Wide Web (WWW);
- 15 - the system has an open architecture for realisation of different VON-packages;
- the system is adapted to cope both with regular traffic between the POTS
20 Network and the Internet and with the transmission of POTS telecommunications over the Internet;
- the system works in the digital domain which makes for high capacity and enables the gateway to manage more parallel connections;
- 25 - the system is adapted to cope with both regular traffic and transmission;
- the system supports direct debiting, especially Ecash, which makes the present invention suitable for using payphones on the Internet.

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CLAIMS

1. An Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission for said services, characterised in that said telecommunication system includes a gateway system adapted to connect at least one telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:

- Internet users and users of said at least one telephone network; and
- said telephone network users.

2. An Internet telecommunication system as claimed in claim 1, characterised in that said gateway system includes a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet, and a gateway locator system for locating that one of the set of gateways which is best suited for a particular telephone call.

3. An Internet telecommunication system as claimed in claim 2, characterised in that a gateway includes a WWW server; a VON package; a charging system; proxy processing means; a TCP/IP interface; an IVR system; a POTS interface; and call control and monitoring means for controlling and monitoring said proxy process, VON package, and charging system, in that said WWW server is connected to said VON package, said charging system, said proxy process means, and said TCP/IP interface, and in that said IVR system is connected to said charging system and said POTS interface.

4. An Internet telecommunication system as claimed in claim 3, characterised in that said gateway has a hardware platform in the form of a high-performance personal computer, said computer including a TCP/IP interface and an IVR system.

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5. An Internet telecommunication system as claimed in any of claims 2 to 4, characterised in that said telephone networks are POTS networks.

6. An Internet telecommunication system as claimed in any of the claims 2 to 5, characterised in that said gateway locator system includes a WWW server and a DNS system.

7. An Internet telecommunication system as claimed in any one of the preceding claims, characterised in that said gateway system is adapted to support a number of connectivity arrangements for said telephone networks and said Internet computers.

8. An Internet telecommunication system as claimed in claim 7, characterised in that said gateway system is adapted to support telephone call connections over the Internet between an Internet computer and a user of said telephone networks and vice versa.

9. An Internet telecommunication system as claimed in claim 7, or claim 8, characterised in that said gateway system is adapted to support telephone call connections over the Internet between Internet computers and between users of said telephone networks.

10. An Internet telecommunication system in which telephony and related services are provided using the Internet as a transmission medium for said services, characterised in that said telecommunication system includes:

- at least one telephone network;
- a gateway system, including a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:
 - Internet users and users of said at least one telephone network;

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and

- said telephone network users; and
- a gateway locator system connected to the Internet and adapted to locating that one of said set of gateways which is best suited for a particular telephone call.

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11. A gateway system for an Internet telecommunication system, characterised in that said gateway system is adapted to connect a telephone network to the Internet and to thereby facilitate telephony interworking, over the Internet, between:

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- Internet users and users of said at least one telephone network; and
- said telephone network users.

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12. A gateway system as claimed in claim 11, characterised in that said gateway system includes a coherent set of gateways, each one of which is adapted to connect a telephone network to the Internet, and a gateway locator system for locating that one of the set of gateways which is best suited for a particular telephone call.

20

13. A gateway system as claimed in claim 12, characterised in that a gateway includes a WWW server; a VON package; a charging system; proxy processing means; a TCP/IP interface; an IVR system; a POTS interface; and call control and monitoring means for controlling and monitoring said proxy process, VON package, and charging system, in that said WWW server is connected to said

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VON package, said charging system, said proxy process means, and said TCP/IP interface, and in that said IVR system is connected to said charging system and said POTS interface.

14. A gateway system as claimed in claim 13, characterised in that said

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gateway has a hardware platform in the form of a high-performance personal computer including a TCP/IP interface and an IVR system.

15. A gateway system as claimed in any of claims 11 to 14, characterised in that said at least one telephone networks are POTS networks.

16. A gateway system as claimed in any of the claims 12 to 15, characterised in that said gateway locator system includes a WWW server and a DNS system.

17. A gateway system as claimed in any of claims 11 to 16, characterised in that said gateway system is adapted to support a number of connectivity arrangements for said at least one telephone network and said Internet computers.

18. A gateway system as claimed in claim 17, characterised in that said gateway system is adapted to facilitate the connection of a number of telephone networks to the Internet and to support call connections over the Internet between an Internet computer and a user of said telephone networks and vice versa.

19. A gateway system as claimed in claim 18, characterised in that said gateway system is adapted to support telephone call connections over the Internet between Internet computers and between users of said telephone networks.

20. An Internet telecommunication system, characterised in that said telecommunication system includes a gateway system as claimed in any of claims 11 to 19.

21. In an Internet telecommunication system as claimed in any of claims 1 to

- 26 -

10, or claim 20, a method for processing telephone calls over the Internet, characterised by the steps of a gateway location phase, a call connection phase, a call connected phase and call disconnect phase.

22. A method as claimed in claim 21, characterised in that the calling party is a user of an Internet computer and the called party is a user of a telephone network, and in that said gate location phase includes the steps of:

- the computer user:
 - dialling the number, including the country code, of the called party, using a web-browser of the computer user, in an HTML FORM provided by a WWW server at said gateway locator system;
 - choosing, or pre-configuring, a required VON package and Payment System for the call; and
 - on actuation of a 'Submit' button, the web-browser validating the dialled number and, if syntactically correct, submitting the information to the WWW server at said gateway locator system;
- the WWW server consulting a Naming System that finds the most suitable gateway for the telephone call, the WWW server generating new web-pages including a clickable gateway button with associated URL, corresponding to a first preference gateway, second preference gateway etc., each URL having associated therewith either the number dialled by the computer user, or a new number in those cases where a redirect was encountered in the search phase;
- the computer user then clicks a gateway button and is connected to a web-server at the gateway; and
- the dialled, or new, number, is transferred to the gateway, together with the VON and billing information, the IP address of the calling computer being automatically transferred to the gateway by means of HTTP.

23. A method as claimed in claim 22, characterised in that validation of the

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dialled number is effected using a Java-script associated with the HTML FORM.

24. A method as claimed in claim 22, or claim 23, characterised by using the same HTML syntax, as for Internet search-engines.

5 25. A method as claimed in claim 24, characterised in that the HTML syntax used is ` best-gw `, the text following the "?" being respectively interpreted, not as search strings, but as the dialled number, VON package to be used, and Billing Method to be used.

10 26. A method as claimed in any of claims 22 to 25, characterised in that said call connection phase includes the steps of:

- said gateway web-server transferring a web-page with an 'Accept' and an 'Abort' button to the calling computer;
- 15 - the gateway establishing a connection to the calling computer using said VON package;
- the computer user accepting the incoming call, if not automatically accepted;
- an IVR system of the gateway issuing a voice message signal to inform
20 the computer user concerning:
 - the charges which apply to the dialled telephone number; and
 - the Payment System which has been chosen;
- and to instructing the computer user to push the 'Accept' button;
- the computer user pushing the 'Accept' button and thereby causing a Call
25 Progress Web-page to appear, said web-page containing a Java-script that periodically requests reload of this web-page from the server;
- the gateway web-server then attempts to establish a call connection to the dialled telephone number, said VON package enabling the computer user to listen to the progress of the call;

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- when a call connection is established, the called party answers the call; and
- issuing an initial payment request to the computer user, if Ecash is used as the payment method, or initiating a charging record for the call.

5 27. A method as claimed in claim 26, characterised in that said Call Progress Web-page contains information about the status of the call and, if Ecash is used, shows, in a 'time left' field, how many seconds are left for use by the calling party before a new deposit is necessary.

10 28. A method as claimed in claim 26, or claim 27, characterised in that, during said call connected phase, said method includes the steps of the Call Progress Web-page:

- informing the computer user of the current status of the call; and
 - if Ecash is used, providing the computer user with a 'New Deposit' button
- 15 for actuation by the computer user when a new Ecash deposit is required.

29. A method as claimed in claim 28, characterised in that actuation of said 'New Deposit' button causes a CGI-script to be started at the gateway web-server which issues an Ecash payment request to the computer user, and in that, on receipt of an Ecash deposit, the gateway web-server increase the 'time

20 left' field on the Call Progress Web-page.

30. A method as claimed in any of claims 21 to 29, characterised in that said call disconnect phase includes the steps of:

- 25 - in the event that either party disconnects the call, the gateway web-server modifies the Call Progress Web-page to inform the computer user that the call has been terminated, and the reason for termination;
- the computer user is given the option, through use of clickable buttons, to either reconnect, or 'quit', the call; and

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- in the event that the computer user clicks the 'quit' button, the computer is connected to the gateway locator system and, if a charging record is open, it is now closed.

5 31. A method as claimed in claim 21, characterised in that the calling and called parties are each a user of an Internet computer and in that the method for processing telephone calls between said Internet computer users is effected in a manner as claimed in any of claims 22 to 30 except that, during the gateway location phase, an IP number, or domain address, is entered by the calling party, rather than a telephone number.

10 32. A method as claimed in claim 21, characterised in that the calling party is a user of a telephone network and the called party is a user of an Internet computer, and in that said gate location phase includes the step of the telephone network user dialling the number to the user's service provider and
15 being routed to a gateway best suited for the call.

20 33. A method as claimed in claim 32, characterised in that the routing of the call to a gateway is effected using automatic call distribution techniques to obtain load balance between gateways.

25 34. A method as claimed in either claim 32, or claim 33, characterised in that the call connection phase includes the steps of:

- the telephone network user:
 - receiving a voice message signal (prompt) requesting the selection of a connection to either another telephone, or an Internet computer; and
 - selecting the Internet computer using touch-tone dialling;
- requesting the telephone network user to enter an IP-number, said entry being read back to the user by the gateway for verification by the user;

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- a web-server of the gateway consulting a DNS to verify the address of the called Internet computer;
- the gateway, on verification of the address, establishing a connection to the called Internet computer using an appropriate VON package, the calling party being informed of the status of the call by call progress audio signals; and
- the called party answers the call, on establishment of the connection.

35. A method as claimed in claim 34, characterised in that access can be obtained either through:

- a freephone-number, in which case the calling party is requested to provide a PIN-code, or
- 'primary rate', in which case additional charging is not required.

36. A method as claimed in claim 34, or claim 35, characterised in that said IP-number is entered either in format 1111#2222#3333#4444#, or in domain name format aaaa#bbb#cc using touch-tone coding of the alphabet, a single click of a push button '1' being used for an 'a', a double click for a 'b' etc.

37. A method as claimed in any of claims 34 to 36, characterised in that the gateway web-server verifies the VON package capability of the calling Internet computer.

38. A method as claimed in any of claims 34 to 37, characterised in that, during the call disconnect phase, either party can disconnect the call, and in that, in the event that the called party disconnects (hangs up), the telephone network user has the option to either initiate another call, or hang up.

39. A method as claimed in claim 21, characterised in that both the calling and called parties are each a user of a telephone network, in that the call

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process involves the use of two gateways, one of which ('Ingress' gateway) is used to initiate a point of entry for a telephone network user to the Internet, and the other one of which ('Egress' gateway) is the gateway where the call exits the Internet and enters the telephone network to access the called number, in that the gateway location phase for the 'Ingress' gateway includes the steps of:

- 5 - the telephone network user:
 - dialling the number to the user's service provider and being routed to a gateway best suited for the call;
 - receiving a voice message signal (prompt) requesting selection of a connection to a telephone network, or an Internet computer; and
 - 10 - selecting an Internet computer using touch-tone dialling;
 - the telephone user is then requested to enter the telephone number of the called party, the input being read back to the telephone user by the gateway for verification by the telephone user;
 - on verification of the called party number, the gateway initiates a proxy
 - 15 process for the called party involving contacting said gateway location system for location of an 'Egress' gateway for the call;
- and in that the remaining interactions in the gateway location phase for the 'Egress' gateway are effected in a manner as claimed in any of claims 22 to 25.

20 40. A method as claimed in claim 39, characterised in that the routing of the call to a gateway is effected using automatic call distribution techniques to obtain load balance between gateways.

25 41. A method as claimed in claim 39, or claim 40, characterised in that access can be obtained either through:

- a freephone-number, in which case the calling party is requested to provide a PIN-code, or
- 'primary rate', in which case additional charging is not required.

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42. A method as claimed in any of claims 39 to 41, characterised in that the call connection phase are effected in a manner as claimed in any of claims 26 to 29.

43. A method as claimed in any of claims 39 to 42, characterised in that, during the call disconnection phase, either party can effect disconnection, and in that, in the event that disconnection is effected by the called party (hangs up), the calling party has the option to initiate another call, or hang up.

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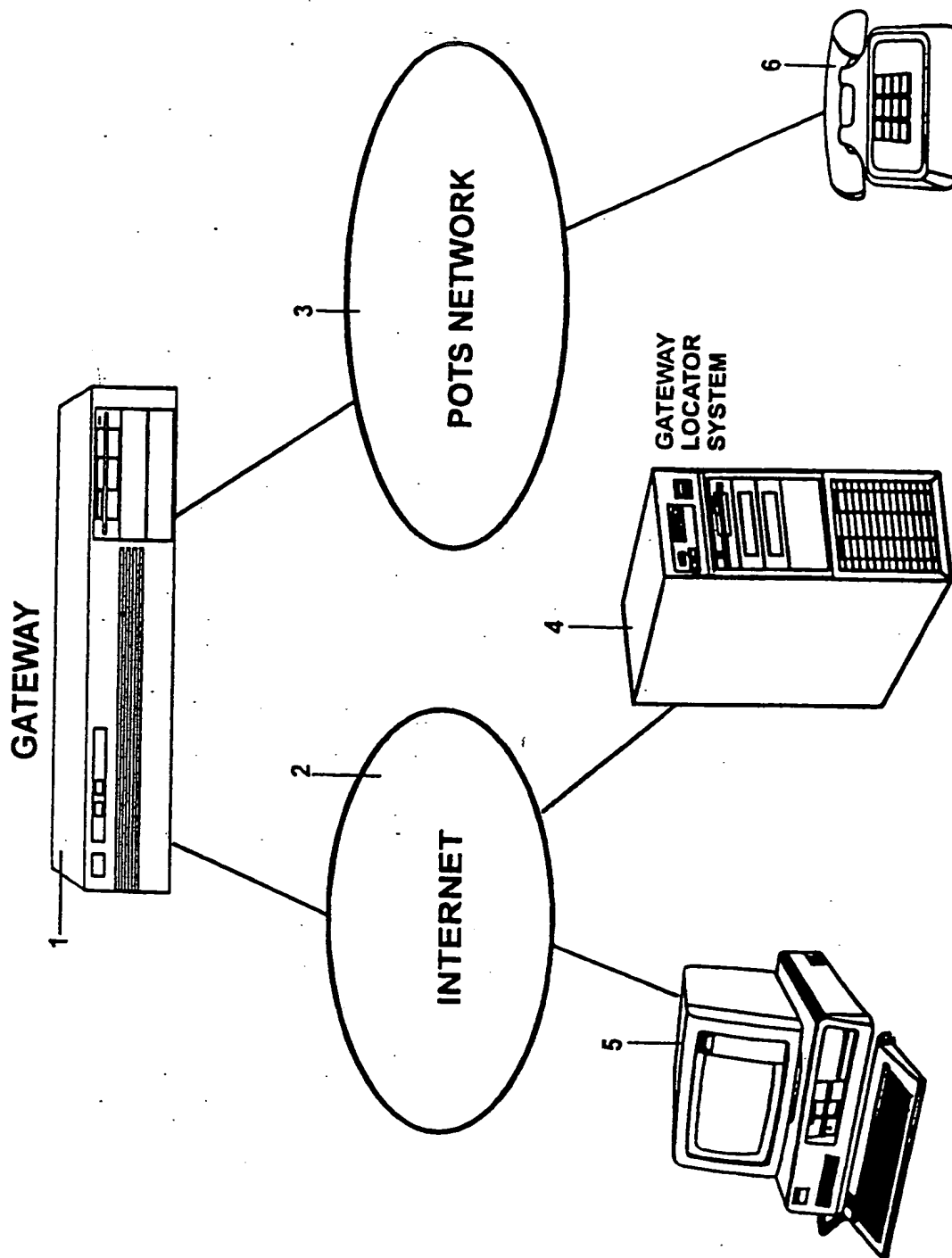


FIGURE 1

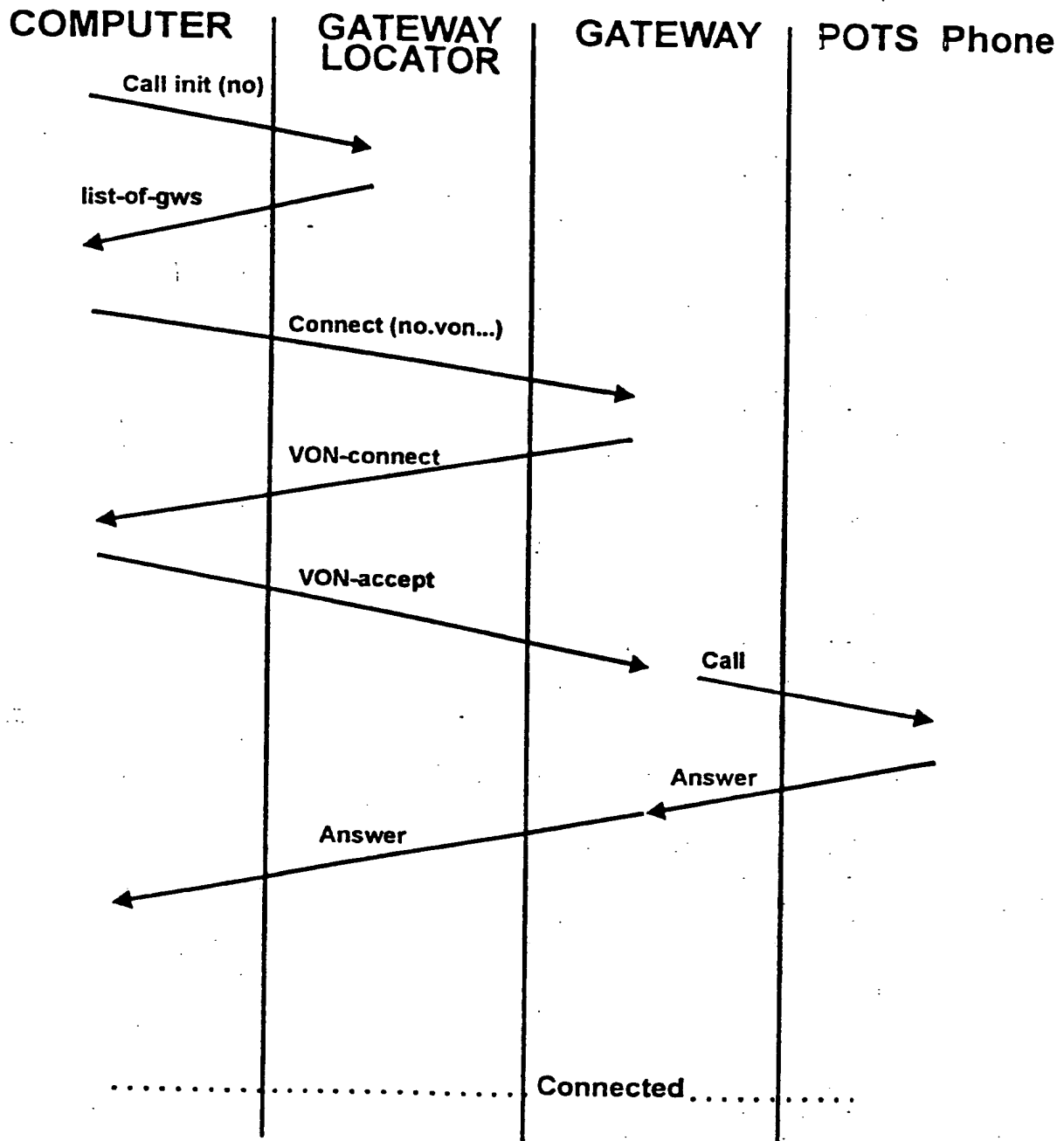


FIGURE 2

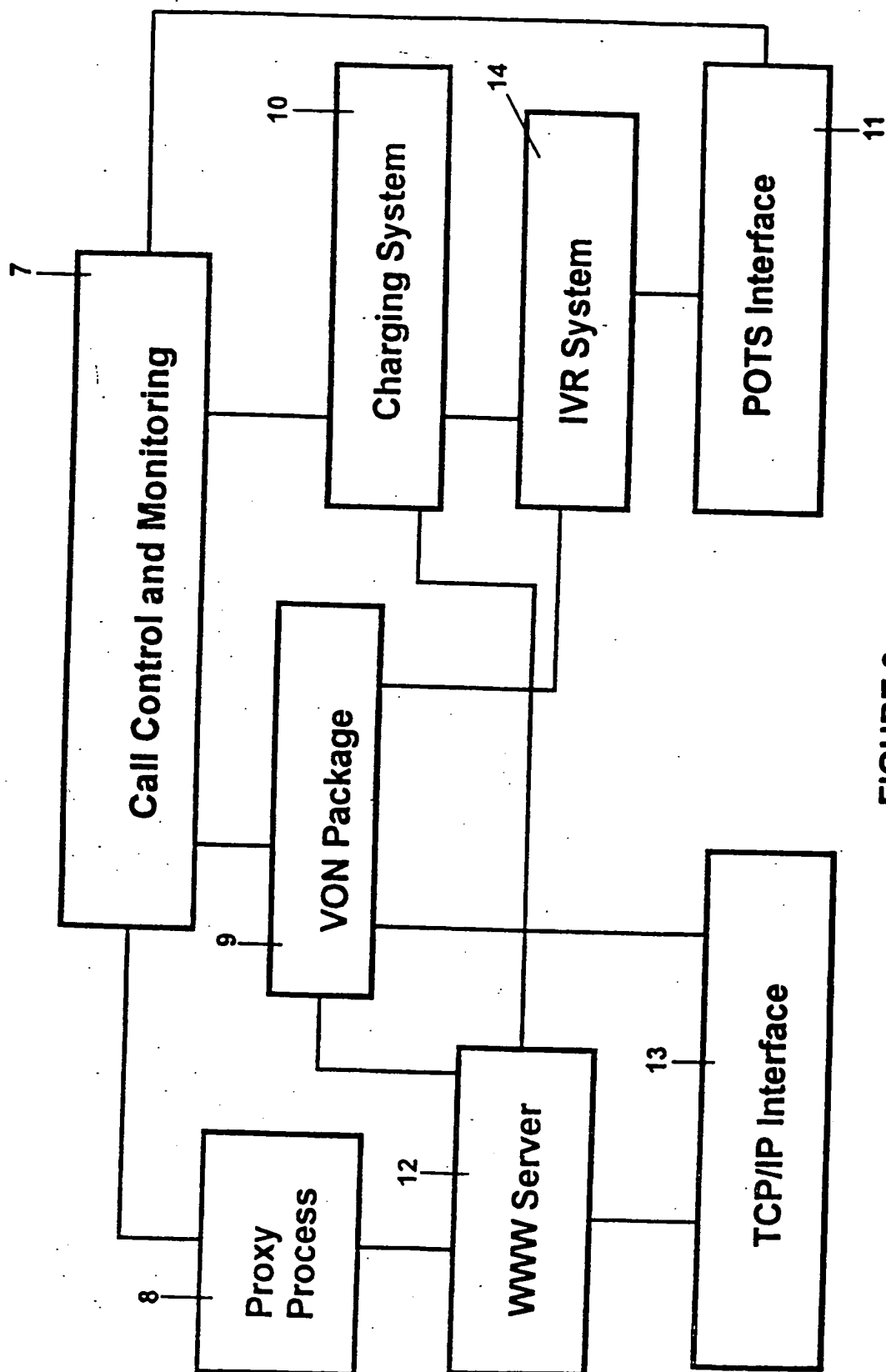


FIGURE 3

SCENARIO	INITIATOR	RESPONDER
1	COMPUTER	TELEPHONE
2	TELEPHONE	COMPUTER
3	COMPUTER	COMPUTER
4	TELEPHONE	TELEPHONE

FIGURE 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01945

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04L 12/66, H04L 12/46, H04M 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EDOC, WPIL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Computer Sweden, Volume, No 73, November 1996, (Sweden), T. Zirner, "BILLIG INTERNET-TELEFONI - VIA VANLIGA TELEFONER" page 12 --	1,2,5-12, 15-21,30,32, 33
P,X	WO 9727692 A1 (FIRETALK, INC.), 31 July 1997 (31.07.97), page 4, line 2 - line 9, figures 2,3 --	1-5,7-15, 17-21,32
P,X	FUNKSCHAU, Volume, No 17, August 1997, (Germany), D. Reusch, "Telefonieren über das Internet" page 44 - page 47 --	1-5,7-15, 17-21,32
P,X	WO 9716916 A1 (TELECOM INTERNET LTD), 9 May 1997 (09.05.97), page 10, line 27 - page 17, line 16 --	1-5,7,10-15, 20,21,32

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "B" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

12 May 1998

Date of mailing of the international search report

13 -05- 1998

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01945

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 0781015 A2 (SONY CORPORATION), 25 June 1997 (25.06.97), column 2, line 12 - line 23; column 3, line 26 - line 55 --	1,2,5,7-12, 15,17-21,32
P,X	WO 9714238 A1 (INTERNATIONAL DISCOUNT TELECOMMUNICATIONS CORP.), 17 April 1997 (17.04.97), page 4, line 27 - page 5, line 2 --	1,2,5,7-12, 15,17-21,32
P,X	WO 9733412 A1 (THOMPSON, JOSEPH, B.), 12 Sept 1997 (12.09.97), page 8, line 18 - page 9, line 2 -- -----	1,2,5,7,10, 21,32

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01945

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 25
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

The HTML-code does not define the matter for which protection is sought in terms of the technical features of the invention (see PCT Rule 6.3(a)).

3. ☒ Claims Nos.: 31, 39-43
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE 97/01945

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
WO	9727692	A1	31/07/97	NONE	
WO	9716916	A1	09/05/97	AU 7682196 A	22/05/97
EP	0781015	A2	25/06/97	CA 2192739 A JP 9168033 A	19/06/97 24/06/97
WO	9714238	A1	17/04/97	NONE	
WO	9733412	A1	12/09/97	AU 2202897 A	22/09/97